



# OLR RESEARCH REPORT

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## **RECOMMENDATIONS ON IMPROVING INFRASTRUCTURE RESILIENCE POST-SANDY**

By: Kevin E. McCarthy, Principal Analyst

You asked for a brief summary of the New York State (NYS) 2100 Commission's assessment of the resilience of infrastructure in the state in the wake of Superstorm Sandy and earlier storms. The assessment's recommendations are very detailed; please let us know if you would like more specific information about them. The assessment is available at <http://www.governor.ny.gov/assets/documents/NYS2100.pdf>.

### **SUMMARY**

The commission found that climate change is increasing the frequency and intensity of severe storms. It also found that rising sea levels associated with rising temperatures will increase (1) the risk of flooding, beach erosion, and damage to infrastructure in low-lying areas during storm surges and (2) the extent of coastal flooding during regular tidal cycles.

In its assessment, the commission describes vulnerabilities associated with climate change in energy and transportation infrastructure, land use, and insurance. Among other things, these vulnerabilities include aging utility facilities and an inability for electric facilities to operate independently when storms affect the grid. Transportation facilities are susceptible to scour, which can undermine their foundations. Other infrastructure, such as wastewater facilities, is often subject to flooding

and the ability of natural systems such as wetlands to mitigate the impacts of climate change are threatened by development and other factors. The state government lacks a unified risk management operation that crosses agencies and covers all hazards. In the private sector, many consumers are unaware of what their property insurance covers.

The commission makes specific recommendations in five areas: transportation, energy, land use, insurance, and infrastructure financing. It also makes recommendations that cut across these areas. Among the recommendations are that the state:

1. develop a risk assessment of its transportation infrastructure;
2. strengthen existing transportation networks, for example by protecting transit systems and tunnels against severe flooding;
3. strengthen critical energy infrastructure by selective undergrounding of electric lines, hardening key fuel distribution terminals, and reexamining the locations of critical components that are at risk;
4. accelerate the modernization of the electrical system;
5. protect coastal communities by restoring dunes, beaches, and barrier islands;
6. update the design, planning, and operation of wastewater facilities to reflect new risks; and
7. establish a new infrastructure bank for financing the construction, rehabilitation, replacement, and expansion of infrastructure.

## **BACKGROUND**

On November 15, 2012, governor Andrew Cuomo convened the NYS 2100 Commission in response to Superstorm Sandy and previous severe weather events experienced by New York and surrounding states. The commission included representatives of academia; nonprofit organizations; engineering, finance, and real estate firms; and the federal government. The governor asked the commission to (1) examine and evaluate key vulnerabilities in the state's critical infrastructure systems and (2) recommend actions that should be taken to strengthen and improve the resilience of those systems. As used in the assessment, "resilience" is the ability of a system to withstand shocks and stresses while maintaining their essential functions.

## **FINDINGS**

### ***Climate Change***

The commission states in its assessment that:

after the damage inflicted by recent extreme storms, it is clear that New York State must prepare for a new normal... The recent storms are not anomalies. They represent further evidence in a developing pattern: an increased frequency and intensity of severe weather attributable to climate change... Climate change can threaten the basic aspects of well-being such as food, shelter, water, energy supply, health and safety. (p. 20)

According to the commission, New York can expect an increase in average temperature ranging from 4°F to 10°F by 2100, primarily in the form of warmer winters. The commission anticipates that extreme weather events, such as heat waves and extreme precipitation events such as downpours, will increase in frequency and intensity. Sustained heavy downpours of rain heighten the risk of localized flash flooding and erosion.

In addition, the commission notes that global sea levels continue to rise steadily due to the melting of the polar glaciers and ocean expansion due to warming. Rising sea levels will have major consequences for coastal communities including:

1. dangerous storm surges caused by high winds and tides, which increase the risk of flooding, beach erosion, and damage to infrastructure in low-lying areas;
2. increased areas of coastal inundation during regular tidal cycles; and
3. regular flooding of coastal wastewater infrastructure and the resulting transmission of pollution to ground and surface waters.

### ***Vulnerabilities***

***Energy.*** The commission finds that the state's electric transmission and distribution lines and substations are aging and vulnerable to damage and outages associated with climate change. This is because they are mostly above ground and insufficiently protected against severe weather, such as flooding, ice storms, and high winds. In addition,

utilities (1) are largely unable to identify specific outages in real-time without manual inspections and (2) often face personnel and equipment shortages when natural disasters affect large regions. Also, the grid does not sufficiently allow, and certain regulatory requirements discourage, power sources and customers to be “islanded” or run as a micro-grid to allow outages to be confined and enable more rapid recovery.

The pipeline system for gasoline and other liquid fuels lacks redundancy and sufficient pumping capacity to avoid widespread impacts in the event that terminals are damaged or must be shut down. The natural gas pipeline system is aging and prone to leaks. It lacks remotely operated valves to limit the impact of damage or leaking pipes.

**Transportation.** The commission finds that bridges, roads, and certain rail infrastructure are susceptible to scour caused by flooding, which erodes the foundations of structures and can undermine the structural integrity of critical transportation links. In addition, flooding poses a major threat to runways, terminals, and other systems at airports located near the coast.

**Land Use.** The commission finds that sea walls and other hard infrastructure are increasingly inadequate to protect against rising tides, storm surge, and high winds from severe storms like Sandy that threaten coastal communities. Wastewater treatment plants and stormwater collection systems are vulnerable to flooding, especially in urban areas with extensive impervious surfaces. Drinking water supplies are threatened by increasing droughts, and watersheds and aquifers serving coastal communities are increasingly vulnerable to salt water intrusion. Critical planning tools, such as hazard maps used for predicting flooding and storm surges, are outdated and not based on advanced technologies for making predictions. Natural systems, such as wetlands, floodplains, and dunes that provide protection from storms, mitigate climate impacts, and retain water to prevent floods, are vulnerable to development and other land use pressures as well as storms.

**Insurance.** The commission notes that the state’s agencies and authorities manage risks separately and lack a unified government-wide risk management operation that covers all hazards. In the private sector, many consumers are unaware of what their property insurance covers and in many cases have little or no insurance. The latter problem is exacerbated by complicated deductible and policy exclusions that leave damage from flooding uncovered or damage from multiple events subject to separate deductibles.

## **RECOMMENDATIONS**

### ***Introduction***

The commission developed recommendations to increase resilience in transportation and energy systems, land use, insurance, and infrastructure finance. These recommendations seek to:

1. identify immediate actions that should be taken to mitigate or strengthen existing infrastructure systems to improve normal functioning and to withstand future extreme weather more effectively;
2. identify longer-term projects that would increase climate resilience as well as provide significant economic and quality of life benefits;
3. assess long-term options for the use of “hard” (constructed) barriers and natural systems to protect coastal communities;
4. create opportunities to integrate resilience planning, protection, and development approaches into economic development decisions and strategies; and
5. make reforms in investment, insurance, and risk management policies related to natural disasters and other emergencies.

The commission also identified nine crosscutting recommendations to improve New York’s overall resilience. These include steps to improve the state’s hard and “soft” (natural) infrastructure, institutions, and information systems.

### ***Transportation***

The commission recommends that the state:

1. assess the risks confronting its transportation infrastructure;
2. strengthen existing transportation networks by protecting transit systems and tunnels against severe flooding and upgrading bridges, tunnels, roads, transit and railroads against all hazards;
3. strategically expand transportation networks to create redundancies, for example by developing a bus rapid transit network and by modernizing signal and communications systems; and

4. change the way it plans, designs, builds, manages, maintains, and pays for the transportation network in light of increased occurrences of severe weather events, for example by expediting environmental review and permitting on major mitigation investments.

## ***Energy***

The commission recommends that the state:

1. strengthen critical energy infrastructure by selectively undergrounding electric lines, raising susceptible infrastructure such as substations, securing locations of future power plants, hardening key fuel distribution terminals, and reexamining the locations of critical components to identify those that are most prone to damage by shocks or stresses;
2. accelerate the modernization of the electrical system and improve its flexibility to incorporate distributed (on-site) generation, microgrids, and plug-in electric vehicles;
3. design rate structures and create incentives to encourage distributed generation and smart grid investments;
4. diversify fuel supply, particularly in the transportation sector;
5. reduce demand for energy and create redundancies by facilitating greater investments in energy efficiency and renewable energy; and
6. develop long-term career training and a skilled energy workforce.

## ***Land Use***

The commission recommends that the state:

1. protect coastal communities by restoring dunes, beaches, and barrier islands;
2. repair hard infrastructure along the coast;
3. develop a comprehensive resilience strategy, including a restoration plan, and storm surge barrier assessment for New York Harbor;

4. reduce inland vulnerability to extreme weather events by expanding wetlands protection in flood prone areas and protecting and securing petroleum, chemical, and hazardous waste tanks located on waterways;
5. update the design, planning, and operation of wastewater treatment facilities, pump stations, and pipes to reflect new risks;
6. develop probabilistic hazards mapping and risk mapping; and
7. strengthen land use programs, standards, policies, guidelines, and procedures to fully prepare for the effects of climate change.

### ***Insurance***

The commission recommends that the state:

1. reduce the risks of climate to the state government by transferring catastrophic risk to capital markets and possibly pre-funding disaster recovery and
2. protect consumers and businesses by promoting investment in risk mitigation and improving consumer awareness and education.

### ***Infrastructure Finance***

The commission recommends that the state:

1. establish a new infrastructure bank to coordinate financing and directly finance the construction, rehabilitation, replacement, and expansion of infrastructure;
2. adopt a standard set of criteria for infrastructure project selection and prioritization;
3. develop a range of sources of revenue, including grants, taxes, and user fees;
4. capture cost savings and avoided losses to generate additional cash flow; and
5. improve the overall policy and regulatory environment for infrastructure investment by enhancing state procurement processes, using public-private partnerships, expediting permitting, and providing tax abatements.

## ***Cross-cutting Recommendations***

The commission recommends that the state:

1. protect, upgrade, and strengthen existing systems (e.g., by returning damaged transportation, energy, drinking water and wastewater systems to a state of good repair);
2. replace infrastructure with better options and alternatives when replacement is not the best option for building long-term resilience;
3. encourage the use of green and natural infrastructure, such as wetlands and dunes, that can serve as natural buffers against storm surges;
4. create statewide and regional banks of critical infrastructure that allow for continuous improvement and modernization in the face of disruptions or failures;
5. promote integrated planning and develop criteria for integrated decision-making for capital investments;
6. enhance institutional coordination, for example by appointing a chief risk officer or unit to coordinate state agencies and neighboring municipalities and using an “all hazards” approach to planning, investment, and decision-making;
7. improve data, mapping, visualization, and communication systems;
8. create new incentive programs to encourage resilient behaviors and reduce vulnerabilities; and
9. expand education, job training, and workforce development opportunities in areas such as restoring ecosystems, creating and maintaining green infrastructure, repairing damaged equipment, and upgrading services.

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